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Beginning Augmentative Communication Systems

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TO BE UNABLE TO PRODUCE communicative behavior that can be understood by others represents one of the most frustrating experiences imaginable. Communicating through a communication board or with gestures lessens this frustration but does not eliminate it. Since 1975, remarkable advances have been made in our ability to provide augmentative and alternative communication services to persons for whom speech is not a viable alternative. This chapter highlights that progress and identifies issues that require further empirical scrutiny.

IDENTIFYING COMMUNICATIVE OBLIGATIONS AND OPPORTUNITIES

Franklin and Beukelman (1991) noted that most of the research on conversational interaction has focused on characteristics of interactions between users of augmentative systems and their speaking partners. Most of these investigations support the notion that augmented communicators primarily respond rather than initiate, produce a limited number of turns within a topic exchange, produce a limited number of communicative functions, and often fail to produce communicative repair strategies. According to Franklin and Beukelman, speaking partners dominate conversations and structure interactions to require minimal responses from users of augmentative communication systems.

Children who use augmentative and alternative communication systems act on as few as 50% of the available conversational opportunities during the course of an interaction (Light, Collier, & Parnes, 1985). An important aspect of communication intervention thus requires that the interventionist carefully

identify the potential communicative opportunities and obligations that occur in a learner's environment. Subsequently, the interventionist must develop instructional objectives to assist the learner in taking advantage of these occasions. A learner's communicative opportunities depend on his or her environment. At work, communicative opportunities may include requesting more work materials, commenting on the food served in the cafeteria, offering a peer assistance in carrying a heavy box, and answering questions posed by a supervisor. In contrast, the communicative opportunities that arise while a learner is playing video games with friends may include commenting on a peer's play, requesting an opportunity to take a turn during the game, and requesting change. The differences in communicative opportunities between these two environments illustrate the importance of conducting environmental analyses in order to develop a comprehensive list of possible communicative situations for a given learner. Conducting this type of analysis will ensure that the communicative needs that are identified are relevant to the learner.

Scrutiny of the learner's environment will yield a continuum of opportunities (Reichle, York, & Sigafoos, 1991). At one end are utterances that require the learner to respond (e.g., "How are you today?"). At the other end are utterances that do not require responses (e.g., "Gee, it's cold."). Although the discussion that follows is couched in terms of obligatory and nonobligatory communicative events, we emphasize the importance of viewing the continuum between the two.

One type of obligatory communicative event that appears to be overused by speakers in talking to users of augmentative communication systems is questions that require a "yes" or "no" answer. Many users of augmentative communication systems appear to adopt the strategy of waiting for their speaking partners to arrange the interaction so that they can simply answer using "yes" or "no." Because a relatively high proportion of obligatory communicative opportunities directed to augmentative system users demand only a yes/no response, the burden for continuing an interaction falls largely on the speaking partner.

The reason for the overabundance of yes/no questions may relate in part to the speed with which such an exchange can occur. During conversations between speakers, utterances can be produced rapidly. Among even the most competent graphic mode users, messages are transmitted significantly more slowly. As a result, there is a tendency for the graphic mode communication system user to be unable to produce messages quickly enough to keep the conversation moving fluently. Other variables may also explain the tendency of participants to rely heavily on yes/no interactions. Some learners may find it physically demanding to use a communication board or gestures. As a result, they may tend to respond only to the most important utterances produced by their communicative partners. Other learners may comprehend far more vocabulary than they are able to produce. Their range of topics available

for discussion may thus be significantly greater if the conversation can be structured to accommodate their production of "yes" and "no" responses to questions.

In some instances, a learner's reluctance to participate fully in a communicative exchange may be the result of learned helplessness (Guess, Benson & Siegel-Causey, 1985; Seligman, 1975). That is, if the desired outcome has historically occurred with minimal learner participation, the learner has been reinforced for minimal participation. There is evidence that, over time, learners placed in such situations tend to become increasingly dependent on those with whom they interact (Guess et al., 1985). To avoid the establishment of learned helplessness, it is crucial that early in a learner's communicative experiences, interventionists identify communicative obligations and opportunities in which the learner will be taught to engage. Accomplishing this task requires a careful match between communicative interactions, communicative intents to teach, and vocabulary.

SELECTING COMMUNICATIVE INTENTS TO TEACH

Cirrin and Rowland (1985) have provided compelling evidence that among persons with severe developmental disabilities with the least sophisticated communicative repertoires, the greatest proportion of their communicative behavior is directed at requesting objects. As learners become communicatively more sophisticated, their proportional use of other communicative intents increases dramatically. Cirrin and Rowland's observations lend credence to the contention by Guess, Sailor, and Baer (1974) that the easiest way to convince beginning communicators of the benefits of communication is to enable them to control access to reinforcers through use of an augmentative communicative system. Of course, if there are important communicative obligations that do not call for requesting, the interventionist should not automatically back away from selecting them as intervention targets.

We believe that an initial repertoire of communicative intents to teach must be carefully matched to the communicative obligations and opportunities each learner experiences. Some communicative intents have very different implications for use in an augmentative communication mode.

An important communicative function is requesting attention. When a speaker makes a request or comment, two communicative functions are performed simultaneously. First, the speaker obtains the listener's attention. Second, the speaker communicates information about a specific referent. Like a speaker, a learner using an electronic communication aid with voice output is able to perform these functions simultaneously. However, in the gestural mode or the graphic mode without voice output, the learner must produce one behavior to recruit attention and a second behavior to communicate a specific idea.

In selecting communicative intents to teach, the interventionst must examine the range of stimulus conditions that should elicit the targeted communicative intent. For example, a number of stimuli call for the production of the utterance "I don't want to do this." In one instance, an undesired item is offered to a learner. In another instance, an item that is normally desired is rejected because the learner has become satiated (e.g., rejecting a third refill of coffee). In a third instance, a learner may be engaged in a neutral event (i.e., one that is neither very boring nor particularly interesting). Over time, the drudgery of the task gradually increases until, at some point, the learner indicates that he or she wishes to discontinue the activity. Ideally, a learner will recognize that in all three of these instances, the same communicative behavior—"I don't want to do this"—could be produced. If this is the case, the learner who has a limited communicative repertoire would maximize the use of that repertoire across stimulus conditions. Unfortunately, for many learners with severe disabilities, establishing this level of generalization is likely to require intervention.

Reichle (1990) demonstrated that three learners who were taught to use a generalized rejecting gesture in the presence of undesired objects readily generalized the use of their rejecting gesture to undesired items that had not previously been the focus of intervention efforts. However, when offered repeated access to an object that served as a reinforcer (coffee), none of the learners used the rejecting gestures after becoming satiated. Two of the learners failed to engage in any communicative behavior upon becoming satiated, and allowed the interventionist to pour more coffee, which they left untouched. The third learner got up and walked away from the table as the interventionist approached.

Reichle (1990) also taught each of three learners to use a reject gesture to escape the delivery of undesired food items. The learners were taught that as the interventionist approached, producing a "no" headshake resulted in the interventionist turning away from them and returning the undesired item to a storage location. All three learners demonstrated generalization of the rejecting gesture to other undesired items that were not the original focus of intervention. However, these learners were unable to generalize the use of the reject gesture to instances in which satiation occurred. For example, one learner's job was assembling ballpoint pens. This learner preferred to assemble blue pens rather than white ones (presumably because white pens required one more assembly step). Traditionally, offering a box of white pens to assemble resulted in an unauthorized leave from work. This learner had a history of darting to escape work some time between 10 and 15 minutes into the task even when blue pens were the focus of the assembly task. Initially, the learner acquired his generalized rejecting response in the context of escaping the presentation of undesired food items at mealtime. Subsequently, the learner generalized his newly acquired rejecting response when an offer of white pens

was made. However, when the staff approached him as his interest in blue pen assembly began to wane and asked, "Want to keep going?", the learner darted rather than produce his reject gesture. Equally poor generalization was observed in the other two learners.

We believe that for the learners whose performance has just been described, the stimulus classes that occasion a particular communicative utterance may be narrowly defined. Consequently, steps need to be taken to ensure that all of the antecedents that we wish to control a particular behavior are, in fact, represented during the acquisition phase of intervention. In the case of the second example presented, the learner's existing communicative behavior at the outset of intervention (i.e., darting) was so socially unacceptable that it had to be replaced. The learner's existing communicative repertoire may not always require actions as drastic as total replacement, however. Consequently, it is very important for the interventionist to consider what existing communicative repertoire the learner may have and what portion of that repertoire can remain part of the learner's long-term communicative system.

INCORPORATING EXISTING REPERTOIRES INTO A COMPREHENSIVE COMMUNICATION SYSTEM

The initial communicative behavior of many learners often contains repertoires of idiosyncratic gestures that have an extensive history of use and are often very efficient means of communication for the learner. These idiosyncratic forms can be thought of as lying along a continuum of acceptability. At one end of the continuum are behaviors such as headshakes representing "yes" and "no" or a raised hand to indicate "stop your approach toward me." At the other end of the continuum are gestures such as crotch holding to indicate a need to use the bathroom. In this instance, the interventionist may be eager to replace the learner's idiosyncratic behavior with a more socially acceptable communicative behavior.

While the notion of social acceptability is a useful dimension on which to evaluate the functionality of idiosyncratic gestures, it is only one dimension. Several other criteria need to be considered when making a decision about whether to leave an idiosyncratic gesture in the learner's repertoire, shape it into a more recognizable form, or replace it with a new behavior. These criteria include: 1) the guessability of the learner's current gesture, 2) the use of an undesired reflex or movement pattern, and 3) the use of an existing repertoire of challenging behavior. Each of these criteria is discussed in the following sections.

Guessability of Gestures

From a listener's perspective, the guessability of a gesture is very important. Consider a learner who asks to go to the bathroom by running for the door of

his classroom and vocalizing loudly. Unless his teacher understands the intent of this message, it is highly likely that she will respond by telling him to return to his seat or by approaching him before he leaves the room. Since neither of these responses is appropriate to his intent, a communication breakdown is almost certain to occur. This is in contrast to other gestures, such as crotch holding or "dancing around," that might be used to communicate the same message. While such gestures are problematic for other reasons (e.g., their social unacceptability), their meanings are clear. In general, gestures that are not highly guessable restrict the communication partner with whom and the settings in which a learner can communicate successfully. For this reason, they are high priority targets for intervention.

Reflex Patterns Used as Communicative Gestures

A learner's initial communicative repertoire may contain idiosyncratic gestures comprised of undesirable reflex or movement patterns. Consider, for example, a learner who produces a gesture using atypical muscle tone or an abnormal coordination pattern. If this gesture is functionally reinforced, over time its continued production could by physically harmful to the learner (Campbell, 1989). Campbell (1989) suggested that if the interventionist decides to leave such a gesture in a learner's repertoire, it should be "shaped into a more normally organized pattern once the pattern is functionally used in self-directed situations" (p. 178). Other alternatives also exist. For example, the interventionist might choose to select a new form of behavior to be taught while placing the existing reflexive gesture on extinction. Decisions regarding the incorporation of gestures that involve the production of undesirable reflex patterns constitute a challenging dilemma that has rarely been addressed.

Challenging Behavior Used as Communicative Gestures

Some learners communicate very efficiently, yet very inappropriately. For example, a child may communicate his refusal to eat green beans by crying and tantrumming. Although the intent of this behavior is clear, the behavior is socially unacceptable. Other, more extreme instances of socially unacceptable communicative behavior include self-injury, aggression, and property destruction. The communicative intents that may motivate these behaviors include requesting, rejecting/protesting, and leavetaking.

The overlap between challenging behavior and communicative behavior presents a host of issues to be addressed by the interventionist. The first of these involves communicative intentionality. Children cry at birth. Yet few would claim that an infant's crying is always intentionally communicative in nature. We do know that very early in life, highly contingent relationships develop between crying episodes and subsequent caregiver behaviors. For example, when an infant cries at feeding time, his or her parents are likely to provide immediate reinforcement in the form of food (milk). Contingent relationships may also develop between antecedent events and the learner's

behavior. For example, an infant may cry or fuss when he or she loses the nipple and has difficulty finding it. In some instances, clear chains of predictable events occur in which an antecedent event (e.g., losing the nipple) is followed by a child's response (e.g., crying), which culminates with a consequence (e.g., providing more food). Although initially the child did not intend to communicate, at some point he or she begins to realize that crying can be used to obtain desired items. What started out as a nonintentional, reflexive behavior may become a deliberate behavior that poses social challenges.

A critical issue for the interventionist is determining whether the challenging behavior is intentional or not. If the behavior is not intentional, the primary thrust of the intervention may be to teach the listener to refrain from reinforcing the behavior, and to identify the antecedent events(s) that typically precede it. Subsequently, a more socially acceptable behavior can be established before the challenging behavior becomes associated with a particular communicative intent. If the challenging behavior is intentional, the primary thrust of intervention must focus on replacing the challenging behavior with a new, more socially acceptable form. In the former instance, the interventionist assumes a more preventive posture. In the latter instance, the interventionist faces a far greater challenge.

Unfortunately, in many instances, it is difficult to identify the precise relationship between a specific challenging behavior and its communicative function(s). However, it is vital to identify clearly the communicative function(s) of the behavior prior to instituting intervention procedures. This principle was demonstrated by Durand and Crimmins (1987), who investigated the influence that teaching a nonmatching communicative intent, such as obtaining attention, had on a challenging behavior that was motivated by a request for assistance. Their data suggested that teaching the communicative function that matched the social motivation of the challenging behavior served to replace the behavior. Teaching a nonmatching communicative function had little influence on the challenging behavior. Additional work to develop a continuum of assessment strategies aimed at matching social intents to challenging behaviors for the purpose of intervention efficiency is critically needed.

Another important factor that influences intervention is the timing of the challenging behavior. In some instances, learners may refrain from engaging in challenging behavior immediately after the precipitating stimulus occurs. For example, one learner may destroy the work materials of a peer. Because a teacher is present, the learner whose materials were destroyed may not retaliate immediately. Instead, he may wait until the peer is alone on the playground to retaliate. If care is not taken to identify the relationship between these two temporally distant events, interventions may fail because a narrow focus on immediate antecedent and consequent events prevent analysis of the bigger picture.

A third factor that may complicate intervention planning is the inconsis-

tency with which some challenging behaviors may be produced in the presence of certain antecedents or consequences. This inconsistency may occur for a variety of reasons. Prior experience with an item or event may influence responding. For example, if a learner has just consumed a plate of beans, offering the learner more beans may provoke rejecting behavior. In other instances, a pre-existing stressor, such as a bad cold, a menstrual period, or having to wear a nonpreferred shirt, may provoke a behavior that would not ordinarily occur.

There is growing empirical support for the use of assessment strategies designed to analyze challenging behaviors in natural contexts through systematic manipulation of antecedents or consequences. A number of investigators (Carr & Durand, 1985; Carr & Newsom, 1985; Carr, Newsom, & Binkoff, 1980; Durand, 1986; Durand & Carr, 1987; Durand & Crimmins, 1987; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; and others) have implemented analog assessment tasks, in which conditions are organized to compare the influence of certain variables upon the production of challenging behavior. For example, in an effort to determine whether challenging behavior was motivated by a desire to request items, Durand (1986) compared a situation in which tangible reinforcers were freely available with a situation in which such reinforcers were visible but not readily available. Table 1 summarizes a number of reports of the use of analog assessment tasks to assess the influence of attention, tangible reinforcers, and task demands on the production of challenging behavior. Such analog assessment tasks must be used in natural contexts in order to preserve the social validity of the outcomes.

To date, few investigations have examined potential variables that may influence the selection of initial communicative targets. Few empirically validated strategies exist for deciding whether to: 1) shape an existing behavior into a communicative utterance, 2) conditionally reinforce an existing behavior used communicatively, or 3) replace an existing behavior with a new, more conventional communicative form. There is a critical need for empirically based investigations of these variables and their influence on the development of efficient intervention procedures. Once a learner's existing repertoire of communication has been identified, the interventionist's attention can begin to focus on selecting the communication mode(s) that might best be used to expand the learner's communicative repertoires.

CHOOSING AN AUGMENTATIVE MODE(S)

The needs of the learner have not always determined the selection of an augmentative and alternative communication mode. Many people with severe developmental disabilities who spent their youths in institutions were taught to use manual signs or gestures simply because few alternatives were available. As the literature on the successful application of graphic mode techniques has

Table 1. Summary of empirical reports that have used analog assessment tasks to assess the influence that attention, tangible reinforcers, and task demands have on the production of challenging behavior

Motivation	Methodology	Study
Effect of attention	A condition in which the excess behavior resulted in obtaining attention was compared to one in which the absence of behavior resulted in attention.	Iwata, Dorsey, Slifer, Bauman, & Richman, 1982; Sturmey, Carlsen, Crisp, & Newton, 1988
	A condition in which relatively little adult attention was available was compared to one in which much attention was available.	Carr & Durand, 1985; Durand & Carr, 1987; Durand & Crimmins, 1988
Effect of tangibles or activities controlled by attending adult	A condition in which the excess behavior resulted in the opportunity to perform various activities controlled by the attending adult was compared to a condition in which no such contingency was in effect.	Lovaas, Freitag, Gold, & Kassorla, 1965
	A condition in which preferred tangibles were freely available was compared to a condition in which the tangibles were visible but not available.	Durand, 1986
Effect of task demands	A condition in which demands were delivered frequently was compared to one in which no demands were delivered.	Carr & Newsom, 1985; Carr, Newsom, & Binkoff, 1976; Carr, Newsom, & Binkoff, 1980; Durand, 1982; Weeks & Gaylord-Ross, 1981
	A condition in which the task was difficult to perform was compared to one in which the task was easier to perform.	Carr & Durand, 1985; Durand, 1982; Durand & Carr, 1987; Weeks & Gaylord-Ross, 1981
	A condition in which task demands and the contingent removal of the demands following the excess behavior were present was compared to one in which task demands were present but their contingent removal was not.	Durand & Carr, 1987; Durand & Crimmins, 1987
	A condition in which task demands and the contingent removal of the demands following the excess behavior were present was compared to one in which no task demands were present.	Iwata et al., 1982; Sturmey et al., 1988

From Doss, L. S., & Reichle, J. (1991). Replacing excess behavior with an initial communicative repertoire. In J. Reichle, J. York, & J. Sigafoos, *Implementing augmentative and alternative communication: Strategies for learners with severe disabilities*. Baltimore: Paul H. Brookes Publishing Co. Reprinted by permission.

grown, so, too, has the proportion of beginning communicators who have been taught to use this mode (Reichle et al., 1991). Some of the advantages and disadvantages of both graphic and gestural modes are displayed in Table 2.

One of the earliest reported attempts to select a primary communication mode systematically was reported by Alpert (1980). She described the implementation of a sequential sampling procedure in which the interventionist first implemented instruction in a single mode. Contingent on an arbitrarily imposed failure criterion being met, a second mode was implemented. Although this sequential sampling strategy was systematic, the learner faced the risk of expending substantial time and effort in attempting to learn to use one or more modes before encountering one that proved useful.

As an alternative, Reichle and Karlan (1985) suggested implementing a

Table 2. Advantages and disadvantages of graphic and gestural modes

Mode	Advantages	Disadvantages
Gestural	• Transporting the system is easy. • Guessing the meaning of some gestures is possible. • Producing gestures is quick. • Communicating with gestures does not require the use of additional materials. • Producing gestures provides a unique topography for each response.	• Communicating with partners who are not familiar with gestural systems may be difficult. • Providing a permanent display of the system is not possible. • Producing gestures requires fluent motor skills. • Requesting specific items (e.g., Milky Way versus candy bar) may be difficult.
Graphic	• System results in a permanent display of symbols. • Communicating with unfamiliar listeners is possible. • Adapting the system for learners with visual impairments is feasible.	• Transporting symbols may be difficult. • Accommodating a large vocabulary may be cumbersome.

concurrent sampling strategy in which both graphic mode and gestural mode intervention were taught concurrently. The advantage of concurrent implementation is that the learner is in a position to use his or her optimal communication mode from the outset of intervention. Assuming that the initial vocabulary items targeted for instruction in the two modes are of equal interest to the learner, over time, it is possible to determine which mode is more useful. Another attractive feature of concurrent sampling is the fact that it parallels the processes that occur in normal development: children without disabilities rely heavily on multiple modes to communicate their initial communicative intents.

Although concurrent modality sampling has received increasing support as a best practice, a number of questions regarding its use remain. Most currently used strategies focus on the introduction of simultaneous mode, mixed mode, and duplicated mode instruction. However, it is not yet clear which implementation strategy best leads to concurrent mode implementation.

Simultaneous Mode

A number of studies have addressed the utility of teaching communication in more than one mode simultaneously. Most of the work in this area has documented the successful implementation of gestural and vocal mode intervention programs (e.g., Barrera, Lobato-Barrera, & Sulzer-Azaroff, 1980; Brady & Smouse,1978). Barrera et al. (1980) found a combined gestural and vocal mode intervention to be more effective in establishing production than either mode taught alone. Brady and Smouse (1978) showed multiple mode intervention to be superior to single mode intervention in establishing an initial

repertoire of comprehension skills. However, other investigators have reported that, when vocal and gestural modes are combined, learners with childhood autism may be more apt to attend to the gestural component than the vocal component (Carr, Binkoff, Kologinsky, & Eddy, 1978). Some research has suggested that the usefulness of simultaneous mode instruction may depend on whether the learner has mastered generalized imitation at the point of intervention (Carr & Dores, 1981; Carr, Pridal, & Dores, 1984; Remington & Clarke, 1983).

Mixed Mode

Keogh and Reichle (1985) speculated that some learners may benefit from a communication system in which some vocabulary items are taught in one mode while other vocabulary items are taught in another. In a mixed mode strategy, vocabulary items are assigned to a particular mode after the interventionist scrutinizes the communicative demands of the learner's environment. Some vocabulary items may be able to be produced with highly guessable gestures. Other items, such as Diet Coke, may require a level of specificity that can be achieved only through the use of graphic mode product logos. Proponents of mixed mode systems suggest that use of a mixed mode allows both the learner and the interventionist to take advantage of the best features of two or more modes.

Duplicated Mode

Proponents of duplicated mode instruction believe that the learner should be able to represent the same vocabulary in both the graphic and the gestural mode. The rationale for a duplicated mode is that it is difficult and impractical to assign vocabulary to a specific mode, since communicative production depends on the situation in which vocabulary is used. For example, a learner with duplicated vocabulary in both the gestural and graphic modes who wishes to ask for a drink while at the playground would probably find it easier to gesture than to take out a communication wallet and locate a symbol. However, when interacting with a babysitter who is unfamiliar with his gestures, the learner might find it more effective to use a graphic symbol. There is some evidence that learners with developmental disabilities can learn to make decisions about the most appropriate modality to use in such situations (Reichle & Ward, 1985).

The introduction of duplicated mode vocabulary often occurs sequentially. For example, a learner may have acquired a significant repertoire of signs and gestures while residing in an institution. Upon moving into the community, the learner is no longer able to rely on signs and gestures, since few people in the community sign. As a result, some of the signs in the learner's repertoire must be duplicated.

Summary

There is a need to maximize the use of multiple modes among prospective users of augmentative and alternative communication systems. However, to date, little attention has been given to which implementation strategy (simultaneous, mixed, or duplicated) might be most efficient with any given learner. The exploration of each of the implementation strategies represents a critical area for empirical scrutiny.

CHOOSING A GRAPHIC MODE SELECTION TECHNIQUE

Once a communication mode(s) has been selected, the interventionist must determine how the learner will access that mode. In the graphic mode, some learners may have physical disabilities so significant that they cannot directly select symbols without the assistance of either the listener or an electronic menuing system. Most intervention studies describing the successful implementation of graphic mode communication systems have focused on the use of a direct selection technique, in which the learner touches, points to, or looks at the symbol or symbol combinations that he or she wishes to communicate. Some investigators have focused on the use of a scanning selection technique, in which the learner is presented with a sequence of symbols, and indicates his or her choice by producing a predetermined signal to inform the listener when the desired symbol has been presented. Traditionally, scanning selection techniques have been reserved for learners who exhibit severe upper extremity motor disabilities, poor head control, and/or poor eye pointing skills.

Few investigators have addressed the range of conditions in which it might be advantageous for a learner to use both direct selection and scanning. Young speakers typically use a combination of direct selection and scanning. At the dinner table, for example, it is common for an 18-month-old to request a specific food item by saying its name. This is a direct selection technique. In other instances, however, the learner may not yet have learned to produce the name of a desired item. In such a case, the learner is apt to point in the direction of a desired item and say "want that." If the desired item is clustered among the food items in the center of the table, it is likely that the communicative partner will then begin to scan through the options, one by one (e.g., "Do you want ketchup? Mustard?"). Although detailed intervention procedures to establish initial scanning skills have been identified (Piché & Reichle, 1991), there is a critical need for investigators to explore the conditions under which it might be advisable to teach both techniques.

There seems to be general agreement that it is more difficult to acquire the use of a scanning technique than a direct selection technique, and there is some research to support this (e.g., Ratcliff, 1988). This may be due, at least in part, to the conditional nature of the discrimination that must be taught to

the user of a scanning technique. When scanning is used, the learner must wait until his or her communicative partner or the cursor on an electronic communication aid highlights a symbol (visually or verbally). Thus, the learner must recognize that a symbol can be selected only under a particular condition and not under any other condition.

Because scanning selection techniques are very slow, a number of variations on a simple scanning technique are available. For example, in row-column scanning, the cursor usually begins at the top-left corner of the learner's communication board and systematically moves down rows. The row containing the target symbol is selected by the learner producing a discrete voluntary signaling response (e.g., pushing a switch). Subsequently, each symbol in the row selected is menued. The learner must once again produce the signaling response to select the exact symbol. The primary advantage of row-column scanning is that it is significantly faster than a simple scanning technique. Typically, learners move from a simple scanning technique to a row-column technique as more symbols are added to their array. However, in order to participate in a row-column scanning technique, the learner must be able to produce a chain of two signaling responses to arrive at the desired symbol. Additionally, the learner must be able to anticipate which row contains the desired symbol by constantly visually monitoring the relative positions of the cursor and the desired target symbol. To date, there has been limited empirical research on reliable intervention procedures that can be implemented to teach learners with developmental disabilities the complex skills needed for row-column scanning. Once a selection technique has been identified and intervention procedures have been designed to enable the learner to become a more efficient user of the technique, attention may be refocused on selecting vocabulary to be represented in the communication models selected.

SELECTING VOCABULARY AND MATCHING VOCABULARY TO COMMUNICATIVE INTENTS

Unfortunately, interventionists often select vocabulary to teach based on what they think might be useful without validating those beliefs. Reichle (1983) conducted a survey in which he asked interventionists to describe the procedures they used to select vocabulary for augmentative and alternative communication system users. The most prevalent strategies, in order of frequency, included: 1) selecting vocabulary that the interventionist and/or parent thought would be important, 2) selecting vocabulary from the first 50 word developmental data, 3) selecting vocabulary from word lists obtained from surveying service providers, and 4) selecting vocabulary from word lists derived from vocabulary actually used by learners with developmental disabilities. Perhaps the most dismaying aspect of the survey was that only 12%

of the respondents reported that they actually scrutinized learners' existing and future environments in an effort to anticipate the range of vocabulary that might be useful.

In a follow-up survey, Reichle (1985) examined the vocabulary items actually used in a 2-week period by 10 learners whose teachers and speech-language pathologists reported that they selected vocabulary in terms of its projected appropriateness. Each learner had mastered a mean of 4.5 symbols that were selected because of their presumed applicability in school. During daily observations across a 2-week period, a mean of 1.5 of these symbols were never used or needed by the learners. A mean of 0.75 symbols were used fewer than five times in the 2-week period. Reichle concluded that over 33% of the vocabulary items selected had minimal applicability to the learners' ongoing daily routines. Ecological inventories were then conducted for each of the 10 learners in order to identify situations that called for a communicative behavior and to which the learners consistently responded in a nonsymbolic manner (e.g., fussing whenever a favorite toy was removed). A mean of 19.8 such instances per day were identified across the 10 learners observed. Clearly, these situations represented excellent opportunities for expanding the communicative repertoires of the learners through the introduction of vocabulary items that corresponded to their nonsymbolic behaviors. Such an approach would appear to be more fruitful than the approach previously used with these learners that made no effort to validate vocabulary selections socially through the use of an ecological inventory. (An extensive discussion of the protocol for conducting an environmental inventory is described in Sigafoos & York, 1991.)

Guessability of Symbols

A number of criteria may be applied to the selection of vocabulary. One of these is the guessability, or iconicity, of a sign or symbol. Iconicity is a term that refers to the notion of how readily a symbol's meaning can be guessed from the information provided. Mustonen, Locke, Reichle, Solbrack, and Lindgren (1991) have suggested that iconicity can be viewed as a continuum with transparent signs/symbols at one end, translucent signs/symbols in the middle, and opaque signs/symbols at the far end of the continuum. A transparent sign is one whose meaning is easy to guess from its topography (e.g., the ASL sign for *toothbrush* is the index finger rubbing back and forth across the teeth). A translucent sign is one whose meaning is not easily guessed without some additional information (e.g., the ASL sign for *milk* is not readily guessable unless one is familiar with the process of milking a cow). An opaque sign is one whose meaning is not readily guessable and whose relationship with its referent seems quite arbitrary (e.g., the sign for *play* is not easily guessable, and bears no apparent relationship to the act of playing). The guessability of a sign or gesture is often cited as an important variable when teaching the use of manual signs. In addition, from the perspective of a

signer who is not familiar with signs, the more guessable the learner's signs, the more likely it is that the listener will be able to decipher them.

Another factor that affects a sign or gesture's guessability is concreteness, that is, how easily the referent is perceived through the senses, particularly sign or touch (Mustonen et al., 1991). For example, *drink* is a very concrete sign, because one can readily see, feel, and imagine holding a glass and drinking. Luftig (1983) reported that learners with moderate to severe disabilities acquire signs rated as transparent and concrete faster than those rated opaque and abstract.

There is also evidence that guessable graphic symbols are more easily acquired than those that are opaque. For example, Hurlbut, Iwata, and Green (1982) found that adolescents with multiple disabilities demonstrated better acquisition, generalization, maintenance, and spontaneous usage of symbols that were transparent than they did of Blissymbols, which are relatively opaque. Sevcik and Romski (1986) found that learners with severe retardation were able to match photographs to their referents more successfully than line drawings. Finally, in a comprehensive study involving 40 learners with mild to severe intellectual disabilities, Mirenda and Locke (1989) identified the following hierarchy of difficulty for nouns across 10 different symbol sets (from easiest to most difficult): real objects, color photographs, black and white photographs, miniature objects, black and white line symbols (including Picsyms [Carlson, 1985], Picture Communication Symbols [Mayer-Johnson Co., 1986], Rebuses [Clark, Davies, & Woodcock, 1974], and Self-Talk symbols [Johnson, 1986]), Blissymbols (Hehner, 1980), and written words. However, only the results for objects, Blissymbols, and written words were found to be significantly different from those of other symbol sets. Much additional information is needed, especially regarding the iconicity and learnability of symbols representing categories other than nouns, to guide practitioners in making decisions about the optimum types of symbols to use for specific learners.

Opportunities for Using Symbols

Karlan and Lloyd (1983) suggested that the number of opportunities to practice the vocabulary chosen may affect the success with which the vocabulary is acquired. That is, the more opportunities the learner has to use the vocabulary, the quicker the learner might acquire it and the greater the likelihood that it will be maintained. Keogh and Reichle (1985), echoing Guess et al. (1974), suggested that vocabulary representing items and events of great interest to the learner represent highly desirable initial intervention targets.

Specificity of Symbols

In addition to the consideration of which vocabulary items would be most useful for the learner to acquire, the interventionist must consider carefully the level of specificity with which to represent vocabulary. For example, in

selecting a graphic symbol to represent Diet Pepsi, the interventionist could choose between a Diet Pepsi container label or, alternatively, a more generic symbol representing all carbonated beverages. How is this decision best made? We know that in normal development learners tend to select symbols of intermediate specificity (Anglin, 1977). That is, given the continuum of *animal, dog,* and *collie,* children are likely to acquire the word *dog* first. Subsequently, the learner will acquire discriminative use of the more general form (i.e., *animal*) and, finally, of the more specific form (i.e., *collie*). Thus, selection of a generic symbol seems natural. In addition, there are a number of other benefits of generic symbols. First, the more generic the symbol, the greater the range of opportunities there are for intervention applications. For example, a symbol for "Oreo" can be used to obtain Oreo cookies only, whereas a more generic "treat" symbol can be used not only to request cookies but to ask for a host of other desirable items as well. Second, generic symbols are less susceptible to satiation and shifting preferences. Third, satiation indirectly influences the frequency of requesting opportunities. If satiation occurs before sufficient instructional opportunities are made available to establish a new vocabulary item, both the learner and the interventionist will experience considerable frustration. The use of shifting preferences is relevant to learners who initially exhibit strong preferences but, over time, lose interest in one or more items as they discover others. For example, a learner may like Diet Pepsi until he discovers Orange Slice; however, if a generic symbol is being used to represent "soft drink" this shift in preference can be accommodated easily.

Accompanying the advantages of more generic symbols are certain disadvantages. The more generic the vocabulary, the greater the demands on the communicative partner to interpret the message accurately. For example, if a learner orders a "soft drink," the listener must make certain inferences to determine what kind of soft drink the learner would like. Currently, there exists no empirical base to assist the interventionist in deciding how specifically initial vocabulary should be represented. Research on symbol specificity must address both the ease of acquisition for the user and the demands for interpretation placed on the communicative partner.

Similarity of Symbols

In both the graphic and gestural modes, the interventionist must consider how the symbols selected are similar or different in appearance. We know that dissimilar response forms are generally more discriminable to the learner. In some cases, response form similarity may actually interfere with establishing initial repertoires. For example, the ASL signs representing *eat* and *drink* are both produced in the same location of the body, using approximately the same handshapes and movement patterns. Additionally, they are often produced in the same setting and in the presence of the similar objects (food and beverages). Best practice literature in the area of discrimination learning suggests

choosing initial responses that are as different as possible. Thus, it would not be wise to teach the symbols both for *eat* and *drink* at the same time and in the same place. Once initial learning has occurred, steps can be taken to introduce new vocabulary items that share increasingly more characteristics with previously established items.

Motoric Complexity of Symbols

In the gestural mode, there is growing evidence that the motor characteristics of some signs may make them easier to acquire. The shape or shapes assumed by the hands, the orientation of the hands and arms to the learner's body, and the location from which the sign or gesture is produced all appear to influence acquisition (Doherty, 1985). Signs and gestures that require contact between both hands or between hand and body (contact signs) have been reported to be easier to acquire than those that do not (Stremel-Campbell, Cantrell, & Halle, 1977). Signs and gestures that require symmetrical movements of both hands (particularly if the movements occur at the anatomical midline) may also be easier to learn (Doherty, 1985).

DELINEATING THE ROLE OF COMPREHENSION IN AUGMENTATIVE COMMUNICATION PRODUCTION

Romski and Sevcik note that "children who do comprehend speech come to the augmented language learning task with knowledge of spoken word referents" (Chapter 5, p. 116). They reported procedures used in a longitudinal investigation that focused on naturalistic intervention techniques to establish electronic communication aid use. After the completion of their investigation, they implemented a retrospective analysis in which learners were divided into two groups. Low comprehenders consisted of those learners who did not understand the spoken words for the initial symbols placed on their communication aids. High comprehenders were learners who did understand the spoken representations for the vocabulary items placed on their communication aids. Romski and Sevcik reported that the high comprehending students learned to recognize and use a larger number of symbols than did their low comprehending counterparts. Additionally, the high comprehenders moved more quickly from line drawn graphic symbols to printed words. The authors suggest that comprehension was the route by which their subjects learned to produce language.

This logic seems compelling, especially since the subjects were taught to use electronic communication aids with synthetic speech output. Thus, each time the learners produced a message by touching a symbol, they heard the corresponding spoken word modeled. Assuming that the spoken output of the electronic communication aid was sufficiently intelligible for the learners to understand it, those learners who were able to comprehend spoken utterances were in a better position to learn from this spoken input.

Although it seems logical that there would be a correspondence between the ability to produce and comprehend vocabulary within a given communication mode, relatively few data demonstrate such a relationship. For example, in the vocal mode, there is a good deal of corroborative evidence to suggest that children's initial expressive and receptive repertoires are often different (Guess, 1969; Guess & Baer, 1973; Siegel & Vogt, 1984).

In the graphic mode, the distinction between receptive and expressive communicative repertoires is less clear, highlighting the fact that these two repertoires are perhaps best viewed as different points along a continuum rather than as separate entities. For example, in the graphic mode, when the samples are real objects or events, the learner's responsibility is to select the matching graphic representation from an array. This task meets the conditions for an expressive discrimination. In contrast, when the samples are line drawings and the choices are real objects, the task is similar to a receptive discrimination.

It may be easier to generalize across reception and expression in the graphic mode since the learner engages in the same form of response regardless of whether the task is receptive or expressive—in both instances, the learner points to either a graphic representation or a real item. Nevertheless, some individuals with severe disabilities have difficulty generalizing when what have been choices in a nonidentity graphic mode matching array become samples and what have been samples become choices (Brady & Saunders, in press).

In summary, few data directly address the relationship between reception and expression among users of augmentative and alternative communication systems. We have not yet satisfactorily resolved whether comprehension is facilitative of production, as Romski and Sevcik suggest (Chapter 5), or whether the response classes of reception and expression are somewhat independent. Also unclear is the extent to which stimulus overselectivity may influence the benefit to language understanding derived from pairing speech synthesized/digitized output with symbol selections. The relationship between reception and expression in augmentative and alternative communication system users is ripe for applied research.

TAILORING INTERVENTION TECHNIQUES TO LEARNING STYLES

Since 1980 a significant and growing array of intervention strategies that can be used to implement an initial repertoire of augmentative and alternative communication skills has been developed. Unfortunately, few investigators have addressed decision strategies to use in selecting an intervention strategy from those available that might best suit the learner's style of acquiring new skills.

Of particular importance is comparing the conditions under which each of two acceptable intervention procedures might be used. For example, sever-

al significantly different intervention procedures aimed at establishing an initial repertoire of leavetaking communicative behavior can be identified. In one procedure, the interventionist teaches the learner that producing a leavetake gesture or graphic symbol will virtually always result in release from task. Once the learner is using this communicative form, the interventionist begins to introduce a delay prior to consequating the learner's production. In effect, the learner is told "just a second" and is then released. Over time, this delay prior to release is increased. Eventually, the interventionist may request the learner to continue to engage in the task at hand for a brief time prior to release. Gradually, this length of engagement may be increased.

An alternative procedure involves teaching the learner to engage in an activity for a brief period and then be released to a break. Early in the program, the interventionist introduces a "safety signal." Its function is to signal the learner that if he or she refrains from unacceptable behavior for a brief period of time, he or she will be released from the activity. Once the safety signal has been conditioned and the learner is participating during greater intervals of time, the interventionist begins to introduce a symbol for leavetaking. The symbol is made available just prior to the safety signal. As soon as the learner comes in contact with the symbol, after the delivery of the safety signal, he/she is released to a break. Inadvertent selections prior to the safety signal are not reinforced with release from the task.

In the latter procedure, the use of a leavetaking symbol is conditionally reinforced from the beginning, thereby avoiding the necessity of placing the learner's use of a symbol on extinction. In the former procedure, conditional uses of the leavetaking gesture were gradually shaped.

EDUCATIONAL AND CLINICAL IMPLICATIONS

A number of implications for best practice can be derived from recent empirical advances. Some of these best practices focus on the selection of initial communicative intents to teach, vocabulary to best represent those intents, and communication modes that will be implemented to enable the learner to produce communicative utterances. Traditionally, interventionists have focused on establishing a single communication intent during the early phases of communication intervention. Evidence described in this chapter suggests that such a practice may make it more difficult to establish a fully generalized repertoire of communicative intents.

Additionally, we know that for some communicative intents, nonelectronic augmentative communication system users must engage in significantly more effort to derive the same outcome as their vocal mode counterparts. For a learner using a nonelectronic communication device, requesting attention and requesting object intents must be two separate chained acts. A verbal mode user consolidates these two communicative intents when he or she yells a request for a desired object.

There are indications that traditional communicative intents designed to describe pragmatic intents may actually describe response classes that are too broad for persons with severe disabilities. For example, a learner may request assistance either to access a positive reinforcer (e.g., ask for assistance in getting a candy unwrapped) or to avoid or escape a negative reinforcer (e.g., ask for assistance with a highly nonpreferred task in hopes that the interventionist will model performance while the learner watches). Recent evidence suggests that learners may not readily generalize across these two instances. Once a range of objects and activities has been identified as the focus of initial teaching procedures, we believe that a very important consideration focuses on characteristics that include the specificity, the motoric difficulty, and the similarity of graphic symbols and gestures that might be taught.

Sometimes communication interventionists are so intent on identifying new behaviors to teach that they tend to ignore existing repertoires. Interventionists must take greater care in determining learners' existing repertoires. Greater effort is required to determine what portions of the existing repertoire should be left as is, shaped into more appropriate forms, used conditionally, or completely replaced.

As mentioned earlier in this chapter, some learners may have acquired communication systems that will not be efficient in all environments. For example, an individual who has learned to sign will have a difficult time ordering fast food at McDonald's. Instances such as these require a duplicated mode application in which a graphic symbol would be used in the community while sign would continue to be used at home. We believe that interventionists must more thoughtfully consider when to consider implementing duplicated communication modes where indicated without creating an overly cumbersome communication system. We believe that with learners who do not already have a single well-established alternative communication system, concurrent modality sampling described earlier in this chapter represents a viable technique for helping determine the relative contribution of available augmentative modes.

In the area of instructional technology, there is a significant need to disseminate best practice information. Only recently have preservice programs begun to offer courses in augmentative and alternative communication. Among interventionists who received their preservice training before 1980, few studied augmentative and alternative communication systems. This suggests that there is a critical need to develop a continuum of inservice training and technical assistance for professionals and paraprofessionals serving clients in schools, residences, and day care.

DIRECTIONS FOR FUTURE RESEARCH

The study of augmentative and alternative communication is in its infancy. Consequently, much important research remains to be done. Particularly time-

ly is research on: 1) the relationship between comprehension and production for the augmentative system user, 2) the interactional use of augmentative and alternative communication systems, 3) the replacement of challenging behavior with augmentative and alternative systems, and 4) the design of selection techniques to accommodate the learner's level of progress or deteriorating medical status.

To date, the bulk of the intervention research regarding augmentative and alternative communication has focused on the establishment of instrumental communicative intents. With the growing body of empirical demonstrations in this area, the attention of researchers has begun to focus on interactional uses of those instrumental intents. Research suggests that the slowness with which users of augmentative and alternative communication systems produce utterances causes communicative partners to alter their interactive style to "speed up" the interaction. There is a critical need for empirical scrutiny of selection techniques aimed at speeding up interactive exchanges without correspondingly increasing the number of listener queries for message clarification.

Few studies have examined the degree to which learned helplessness affects the establishment of initial communicative repertoires. There is a tremendous need for intervention research that delineates effective strategies to overcome passivity that represents the outcome of extensive histories of learned helplessness.

Interventionists are just beginning to understand fully the relationship between challenging behavior and the lack of a socially acceptable communicative repertoire. We know that the most efficient procedures are those that result in approximation of communicative alternatives in the presence of provoking stimuli. There is a critical need for assessment and intervention research that creatively embraces the technology offered by general case instructional technology.

Finally, the area of prevention has become a significant priority in the delineation of communication intervention programs in early childhood education. However, very little work has been done in the area of prevention of challenging behavior. At present, it is unclear whether it is possible to establish criteria that identify young learners as being at risk for the development of challenging behaviors. We are beginning to learn that the interactional patterns of individuals who engage in challenging behavior may affect the interactional behavior of their communicative partners. This evidence suggests possible avenues for intervention efforts aimed at preventing communicative partners from lapsing into less efficient interactional patterns with those who engage in challenging behavior.

The bulk of assessment and intervention studies have focused on the immediate establishment of systems, and rarely consider longitudinal planning for the use of an augmentative or alternative communication application

across the individual client's life span. Intervention protocols for learners whose physical condition may be deteriorating, thus necessitating the use of a different selection technique, need to be developed.

CONCLUSION

Although the field of augmentative and alternative communication is in its infancy, significant advances have been made. Interventionists and researchers appear to be increasingly sensitive to the effect that selecting particular communicative intents, symbols, and vocabulary may have on the learner's propensity to acquire a generalized and functional communicative repertoire. There seems to be general agreement that most learners can benefit from gestural, graphic, and vocal modes as components of their overall communication system. What is not yet clear, however, is how best to go about determining the relative contributions of each of these modes.

Increasingly, there is a need for instructional procedures that can be used to serve younger learners. These procedures must be sufficiently practical so that they can be taught to all interventionists, including teachers, paraprofessionals, and parents. This represents a particularly challenging task when one considers that procedures must address the acquisition of vocal, gestural, and graphic communication modes.

Adults who may be at risk of losing or failing to be placed in a community residence because of communicatively motivated challenging behavior (e.g., aggression, tantrumming) require intervention procedures that fully address the range of antecedents and consequences that have come to strengthen unacceptable behavior. As with younger learners, there is a need to develop instructional procedures that are practical yet relatively easy to implement. Particularly acute is the need to develop sound inservice and technical assistance models for those who serve adults, among whom turnover is extremely high.

Longitudinal planning must be done in implementing augmentative and alternative communication systems. In some cases, learners using augmentative communication systems can be expected to acquire speech-motor control that may lessen the need for a communication aid. Other learners may become more severely impaired and require augmentative selection techniques that differ from those originally selected. To date, most interventionists' efforts have focused on demonstrating that individual augmentative communication applications can be successful without attempting to plan for the future.

The 1980s witnessed remarkable advances in the area of augmentative and alternative communication. Rapid advances in instructional technology have resulted in the acquisition of substantial communicative repertoires among learners who, in the past, would not have been considered as candidates for communication intervention. We look forward to the next 10 years

with confidence that many of the issues raised in this chapter will have been resolved.

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